

Restoration of Endodontically Treated Teeth

Dr. Marrwa Ibrahim





Lecture 5:

Digital Approach for Restoring Endodontically Treated Teeth: Post and Core



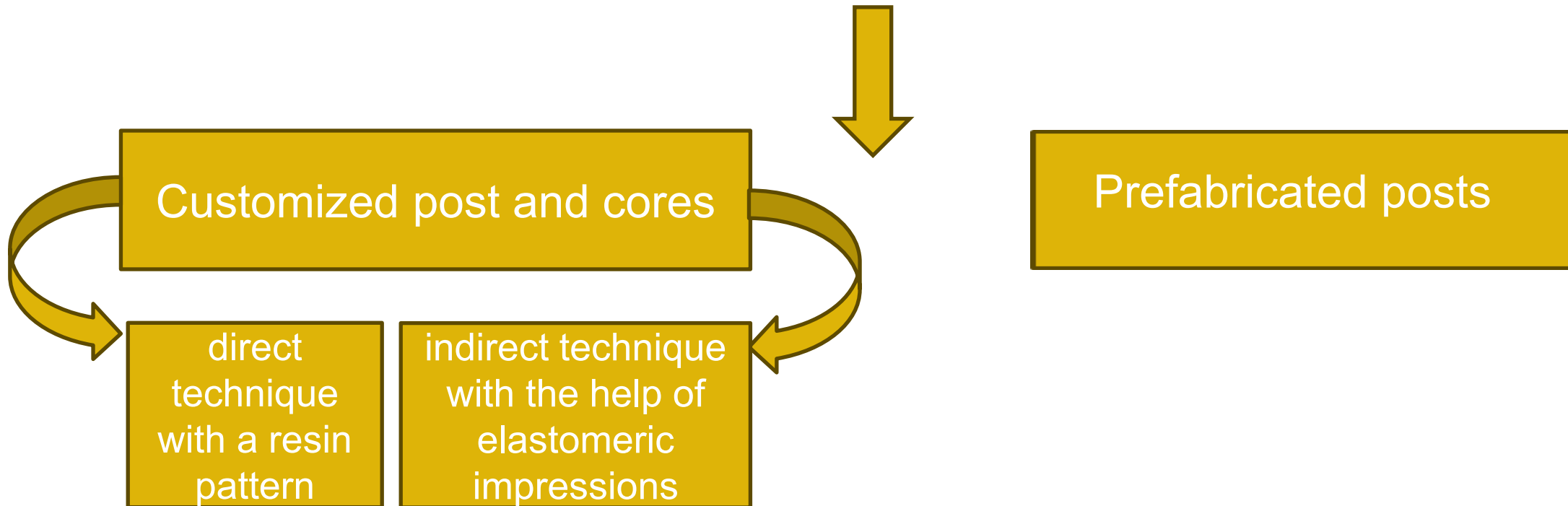
Learning Outcomes

By the end of this lecture, you should be able to:

- 1) Identify drawback and limitation of traditional techniques for post and core fabrication
- 2) Understand CAD/CAM workflows
- 3) Compare the digital approach with the traditional technique
- 4) Apply clinical decision-making



Post and core



The choice of technique relies on factors such as the tooth's condition, the patient's oral health, and the clinician's proficiency



Drawback and Limitations of Traditional techniques for Post a core fabrication

- Shrinkage.
- Distortion.
- Human error.
- Lab variability.
- Multiple visits
- Technique sensitivity
- Material mismatch




Digital Dentistry

Is now reshaping the foundations of how restorative procedures are approached in many fields in the dental industry.

- Digital Scanning
- CAD (computer-aided design)
- CAM (computer-aided manufacturing)

Improves reproducibility, reduces operator dependency, improves accuracy, provide consistency through standardized production protocols

Introduction to CAD/CAM in restoration of endodontically treated teeth:

- Modern dentistry
- CAD (Digital design) + CAM
(manufacturing)  Integration
- Precision workflow

Digital workflow allows simulation and previsualization of outcomes.

- CAD: software modeling (Exocad , 3Shape)
- CAM: milling/printing systems.



CAD/CAM technology encompasses two fundamental approaches:

1. Additive manufacturing (3D printing): brings structures to life by building layer upon layer, each precise deposition contributing to the emergence of intricate forms.

- Efficient with high accuracy
- Minimal waste

Materials used in this technique : resin/metal printing. 

CAD/CAM technology encompasses two fundamental approaches:

2. Subtractive manufacturing: revolves around the art of material removal, sculpting the desired shape by carefully chiseling away.

- High strength
- Material waste

Materials used in this technique :

dense materials (zirconia, Co-Cr)



Materials in CAD/CAM

- Zirconia
- Hybrid ceramics
- FRC composites

Material choice affects fracture mode and long-term prognosis.



Zirconia

- High strength
- Aesthetic
- High stiffness risk
- establishing a strong bond to the acid-resistant zirconia can be challenging
- in case of treatment failure, it may be extremely difficult to retrieve zirconia posts from root canals



Zirconia: strong but risk of catastrophic root fracture due to stiffness.



Hybrid Materials:

Novel materials emerged by blending ceramics with composite resin, resulting in a material that boasts the mechanical properties and color stability of ceramics alongside the elasticity and robustness of resin composites , such as Enamic .

- Elastic modulus close to dentin
- Better fracture behavior



Hybrid: better stress distribution and repairable failure patterns.

FRC Materials :

- Flexible
- Repairable fractures compared to the fracture in case of using zirconia
- excellent aesthetic
- do not require sintering, which reduces manufacturing time and cost.
- FRC: modulus of elasticity closer to dentin, favorable biomechanics properties.

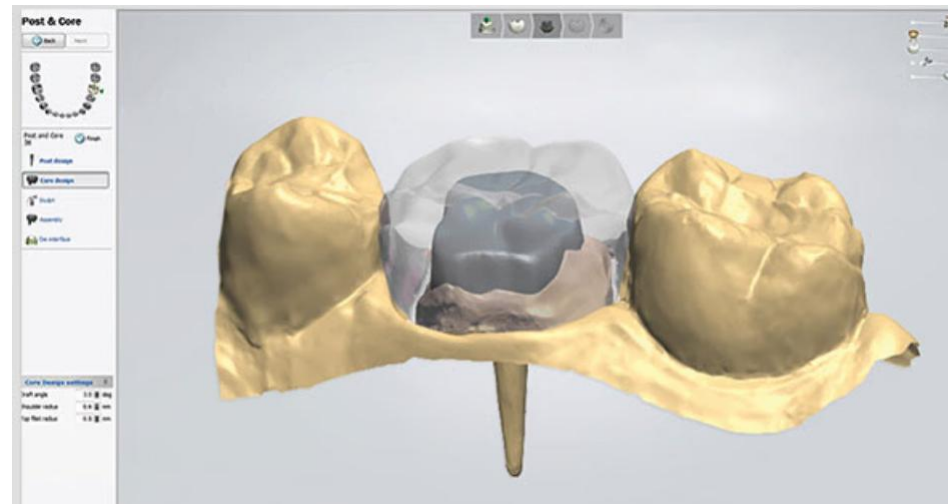


Techniques for Fabricating CAD/CAM Post and Core

Digital Workflow Overview

Scan → Design → Manufacture

Workflow: intraoral scan → CAD design → CAM production.



1. Semi-Digital (Indirect) Workflow:

- **Scan** for impression, resin/wax pattern (scanning the impression requires less chairside time and therefore results in better work efficiency
- **Virtual design** is created using Exocad or 3Shape software
- **Fabrication** of post and core restoration either by Milling or 3D printing.
- Semi-digital: combines impression/ pattern with digital fabrication.



Digital Workflow

1. Post space preparation
2. Digital impression
3. CAD design
4. CAM fabrication
5. Clinical try-in and cementation

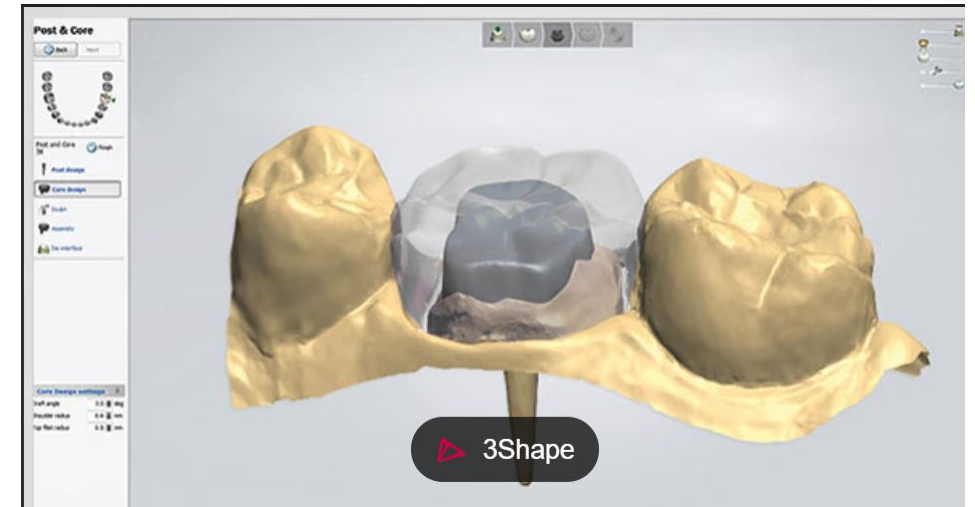


2. Fully Digital (Direct) Workflow:

- **Direct digital impression** of the post space: Using Intraoral scan to scan the prepared post space.
- **Direct CAD design** using Exocad or 3Shape software
- **Fabrication** of post and core restoration either by Milling or 3D printing.
- Fully digital technique is beneficial as it reduces chairside time, simplifies the laboratory procedure for post and core fabrication and eliminates risk of material distortion.
- Depending on efficiency of the intraoral camera system, it might not be indicated for long and narrow post space.

CAD Design Principles:

- Customize post length and taper
- Optimize core contour
- Preserve ferrule



Custom digital design of post and core:

Advantages:

- Precise adaptation
- Improved marginal fit
- Reduced laboratory steps



Advantages of Digital Systems

- Improved precision
- Customization for canal morphology
- Reduced treatment time
- Better lab communication



Limitations of Digital Systems

- High cost of equipment
- Learning curve
- Scanner limitations



CBCT Integration

- 3D canal morphology
- Accurate post design

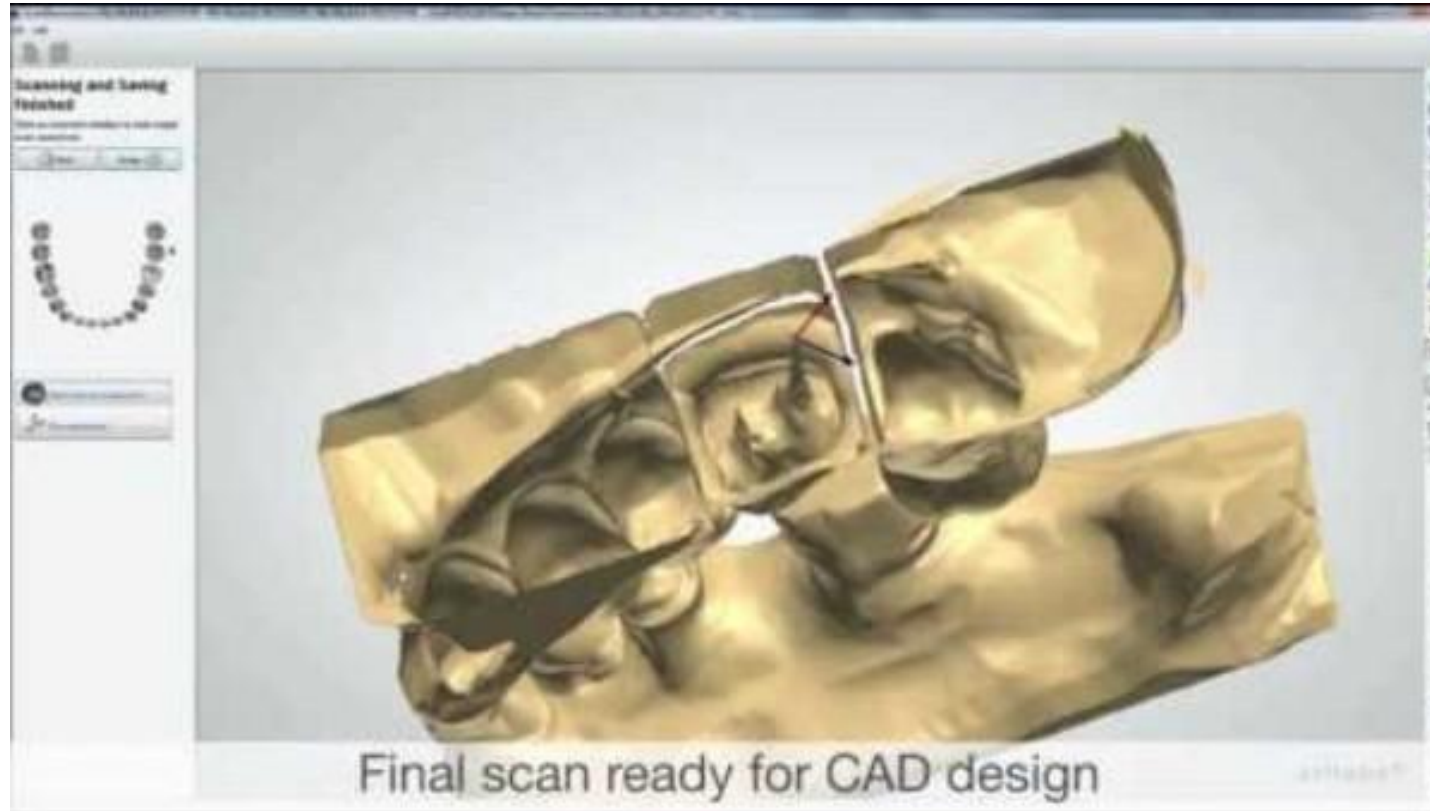
- CBCT enables precise anatomical replication of canal.



Key Clinical Take-Home Messages

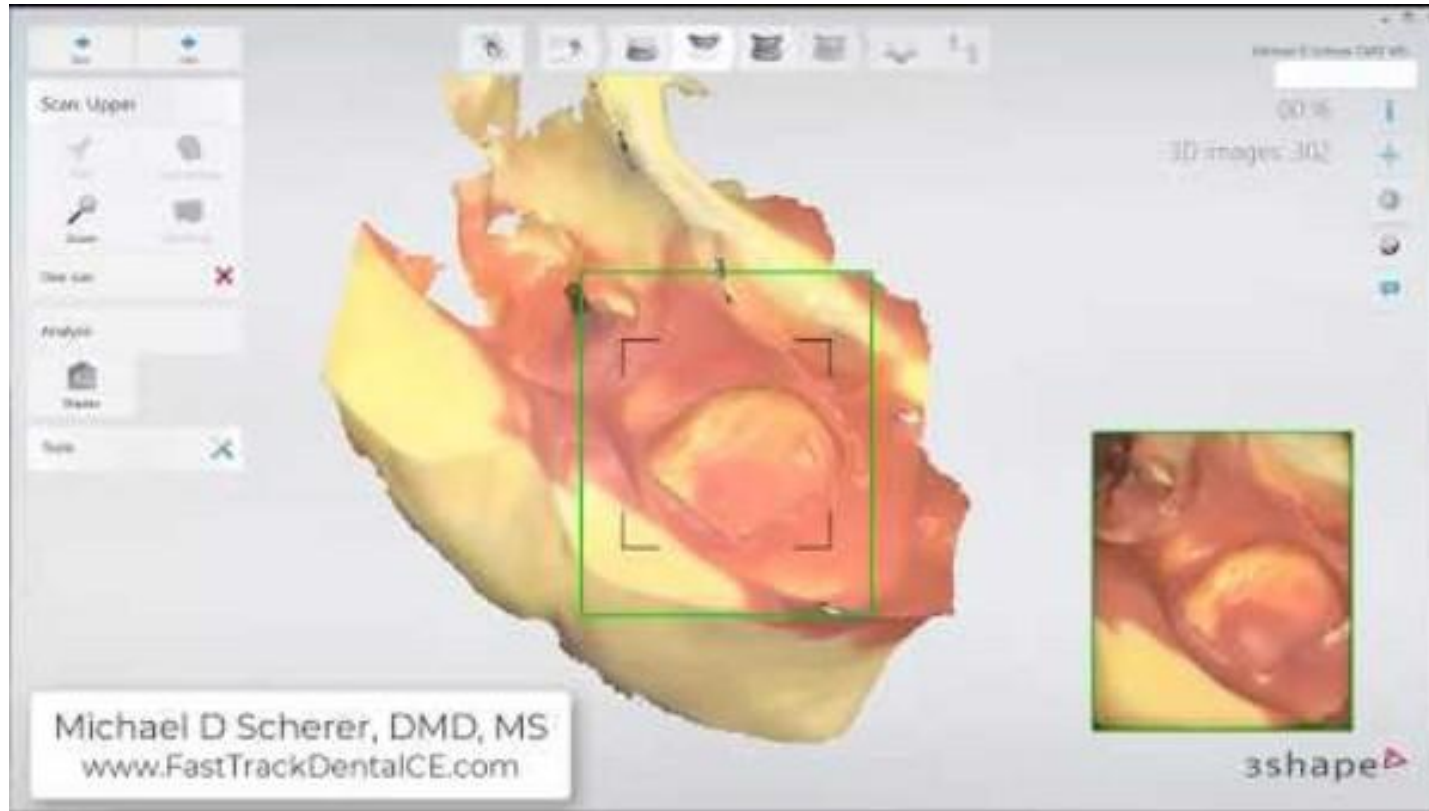
- CAD/CAM is future
- Improved outcomes
- Case-based approach





[Dental System™ 2013 - Post and Core](#)





[3Shape TRIOS Post & Core PVS Hybrid Scanning Technique](#)



References

1. Ahmed RA, Aseri FA, Alammari AS, Asiri ZS, Al Matir FO, Al Shahrani SS, et al.
CAD/CAM technologies in post and core restoration of endodontically treated teeth: current evidence, clinical applications, and interdisciplinary perspectives. *J Clin Pract Med Res.* 2025;1(3):178–189.
2. Rosenstiel SF, Land MF, Fujimoto J.
Restoration of the endodontically treated tooth. In: *Contemporary Fixed Prosthodontics.* Philadelphia: Elsevier; 2015. p. 278–280.
3. al-Qarni FD.
Customized post and cores fabricated with CAD/CAM technology: a literature review. *Int J Gen Med.* 2022;15:4771–4779.
4. Abhishek G, Chakrabarty A, Kavlekar V, Singh Y, Mahajan S.
Prosthetic rehabilitation of endodontically treated tooth by using CAD-CAM milled zirconia post and core system: a clinical report. *Int J Sci Healthc Res.* 2023;8(1):95–97.
5. Lin P, Xu Z, Luo Y, Yin L.
A digital technique for a prefabricated custom post-and-core restoration. *J Prosthet Dent.* (Year not specified in extract).
6. Dimitrova M, Vlahova A, Kazakova R.
Assessment of CAD/CAM fabrication technologies for post and core restorations—A narrative review. *Medicina.* 2024;60:748.



Thank You

